

# Bioindicators of Water Quality

## Quick-Reference Guide

Authors: Julie Speelman and Natalie Carroll | Photographer (unless otherwise noted): Julie Speelman | Design and Layout: Jennifer Mazonas

This publication shows aquatic insects that can be used as bioindicators of water quality in Indiana waterways. Bioindicators are biological systems that are sensitive to environmental changes and, therefore, can indicate when pollution is present in the water.

A tolerance score is included for each insect in this publication. The tolerance score, ranging from 0–10, represents the insect's sensitivity to pollution and can be used to estimate the quality of the water in which the insect was found. Insects with a score of 0 are intolerant to pollution, meaning they cannot tolerate any water pollution, while insects with a score of 10 are very tolerant of polluted water.

### Materials Needed

- dip net
- white plastic pail, bowl, or dishpan (Note: The white color makes it easier to see the insects.)
- 2–3 white styrofoam egg cartons or plastic ice cube trays
- data sheet—available online at: [www.four-h.purdue.edu/natural\\_resources/](http://www.four-h.purdue.edu/natural_resources/) (select “Resources for Educators” and “Bioindicators”)

### Instructions

- Locate a body of water (e.g., stream, pond, lake) to sample. The water should only be at most knee deep and allow easy access for obtaining the sample. Make sure you have permission to sample the water.
- Dip the pail in the water to be sampled.
- Collect insect samples from all habitats within a 200-foot section of that body of water, and place them in the pail. Jab your dip net against the vegetation and into mud or sand at the bottom to collect insects. Scrape the underside of rocks and logs into the net.
- Collect insects for 45 minutes.
- Using the ice cube tray, sort the insects that look the same into the different compartments of the tray using your hand or forceps. Be sure to put some water in the ice cube tray first to keep the insects from drying out.
- Use the bioindicator flash cards or quick reference guide to identify the insects. Record the number of insects from each insect family you identify on the data sheet.
- Place the insects back in the water when you are finished.
- Complete the calculations described in the next section to determine the quality rating.

### Resources

- U.S. Environmental Protection Agency (EPA)
- About Biological Integrity and Indicators: [www.epa.gov/bioindicators/html/about.html](http://www.epa.gov/bioindicators/html/about.html)
- Invertebrates as Indicators (look for Bugs as Indicators of Water Quality): [www.epa.gov/bioindicators/html/invertebrate.html](http://www.epa.gov/bioindicators/html/invertebrate.html)
- Bugguide.net (hosted by Iowa State University Entomology): [www.bugguide.net](http://www.bugguide.net)

Biotic Index	Water Quality Rating	Degree of Organic Pollution
0.00–3.75	excellent	organic pollution unlikely
3.76–4.25	very good	slight organic pollution possible
4.26–5.00	good	some organic pollution probable
5.01–5.75	fair	fairly substantial pollution likely
5.76–6.50	fairly poor	substantial pollution likely
6.51–7.25	poor	very substantial pollution likely
7.26–10.0	very poor	severe organic pollution likely

### Assessing the Water Quality of a Site

*For each insect family group:*

- Record the number of insects found for each species listed.
- Multiply the Tolerance Value by the Number Found, and enter the result under Family Tolerance Score.
- Sum the Number Found and Family Tolerance Score columns (Order Totals).

*For each insect order:*

- Transfer the Order Totals to the Order Summary section.
- Sum the Number Found and Order Tolerance Score columns (Grand Total).
- Determine the Biotic Index by dividing the Grand Total Tolerance Score by the Grand Total Number Found.
- Use the biotic index in the table provided to estimate the water quality rating and degree of organic pollution.

- Hoosier Riverwatch (provides training on this and many other water-related topics): <http://www.in.gov/dnr/nrec/3046.htm>
- Volunteer Stream Monitoring Training Manual (download, 13.7 MB): [http://www.in.gov/dnr/nrec/files/nc-Riverwatch\\_Manual.pdf](http://www.in.gov/dnr/nrec/files/nc-Riverwatch_Manual.pdf); Chapter 5 covers biological monitoring.
- Hoosier Riverwatch events calendar: <http://www.in.gov/dnr/nrec/>

## Coleoptera Beetles



**Dryopidae**  
Long-toed Water Beetle



**Dytiscidae** (larvae)  
Predaceous Diving Beetle



**Dytiscidae** (adult)  
Predaceous Diving Beetle



**Elmidae** (larvae)  
Riffle Beetle



**Elmidae** (adult)  
Riffle Beetle



**Gyrinidae** (larvae)  
Whirligig Beetle



**Gyrinidae** (adult)  
Whirligig Beetle



**Haliplidae** (larvae)  
Crawling Water Beetle



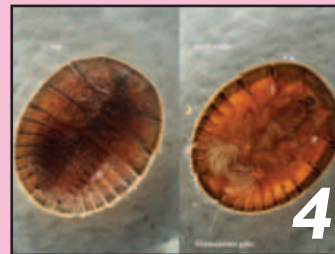
**Haliplidae** (adult)  
Crawling Water Beetle



**Hydrophilidae** (larvae)  
Water Scavenger Beetle



**Hydrophilidae** (adult)  
Water Scavenger Beetle



**Psephenidae** (larvae)  
Water Penny

## Diptera Flies



**Athericidae**  
Aquatic Snipe Fly



**Blephariceridae**  
Net-winged Midge



**Ceratopogonidae**  
Biting Midge



**Chaoboridae**  
Phantom Midge



**Chironomidae**  
Non-biting Midge



**Culicidae**  
Mosquito



**Dixidae**  
Dixid Midge



**Empididae**  
Aquatic Dance Fly



**Ephydriidae**  
Shore Fly



**Muscidae**  
House Fly, Stable Fly,  
Green Bottle Fly





10

**Psychodidae**  
Moth Fly



3

**Tipulidae**  
Crane Fly



6

**Sciomyzidae**  
Marsh Fly



6

**Simuliidae**  
Black Fly



8

**Stratiomyidae**  
Soldier Fly



10

**Syrphidae**  
Rattailed Maggot



6

**Tabanidae**  
Horse Fly, Deer Fly

## Ephemeroptera Mayflies



4

**Baetidae**  
Small Minnow Mayfly



3

**Baetiscidae**  
Armored Mayfly



7

**Caenidae**  
Small Square-gill Mayfly



1

**Ephemerellidae**  
Spiny Crawler Mayfly



4

**Ephemeridae**  
Common Burrowing Mayfly



4

**Heptageniidae**  
Flat-headed Mayfly



2

**Isonychiidae**  
Brushed-legged Mayfly



4

**Leptohyphidae**  
Little Stout Crawler Mayfly



2

**Leptophlebiidae**  
Prong-gilled Mayfly



2

**Polymitarcyidae**  
Pale Burrowing Mayfly



4

**Potamanthidae**  
Hacklegill Mayfly



7

**Siphonuridae**  
Primitive Minnow Mayfly

## Hemiptera Aquatic Bugs



10

**Belostomatidae**  
Giant Water Bug



9

**Corixidae**  
Water Boatman



Undetermined

**Gelastocoridae**  
Toad Bug



Undetermined

**Gerridae**  
Water Strider



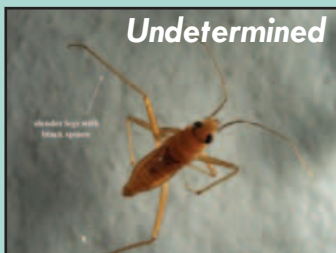
Undetermined

**Hebridae**  
Velvet Water Bug



Undetermined

**Hydrometridae**  
Water Measurer



Undetermined

**Mesoveliidae**  
Water Treader



5

**Naucoridae**  
Creeping Water Bug



8

**Nepidae**  
Water Scorpion



Undetermined

**Notonectidae**  
Backswimmer



Undetermined

**Pleidae**  
Pygmy Backswimmer



Undetermined

**Saldidae**  
Shore Bug



6

**Veliidae**  
Broad-shouldered Water Strider

## Lepidoptera Aquatic Moths



5

**Pyralidae**  
Aquatic Caterpillar

## Megaloptera Alderflies, Dobsonflies, and Fishflies



0

**Corydalidae**  
Dobsonfly



4

**Sialidae**  
Alderfly



9

**Coenagrionidae**  
Narrow-winged Damselfly

## Odonata Damselflies and Dragonflies



3

**Aeshnidae**  
Darner



5

**Calopterygidae**  
Broad-winged Damselfly



1

**Gomphidae**  
Club-tailed Dragonfly



9

**Lestidae**  
Spread-winged Damselfly



7

**Libellulidae**  
Common Skimmer



## Plecoptera

### Stoneflies



#### Capniidae

Small Winter Stonefly



#### Leuctridae

Roll-winged Stonefly



#### Nemouridae

Brown Stonefly



#### Perlidae

Common Stonefly



#### Perlodidae

Patterned Stonefly

## Trichoptera

### Caddisflies



#### Brachycentridae

Humpless Casemaker Caddisfly



#### Glossosomatidae

Saddle Casemaker Caddisfly



#### Helicopsychidae

Snail Casemaker Caddisfly



#### Pteronarcyidae

Giant Stonefly



#### Taeniopterygidae

Winter Stonefly



#### Hydropsychidae

Common Net Spinner Caddisfly



#### Hydroptilidae

Micro Caddisfly



#### Lepidostomatidae

Lepidostomatid Casemaker



#### Leptoceridae

Long Horned Casemaker



#### Limnephilidae

Northern Casemaker Caddisfly



#### Philopotamidae

Finger Net Caddisfly



#### Phryganeidae

Giant Casemaker Caddisfly

# Using this guide with the data sheets

## Coleoptera Beetles



**Dryopidae**

Long-toed Water Beetle



**Dytiscidae** (larvae)

Predaceous Diving Beetle



**Dytiscidae** (adult)

Predaceous Diving Beetle

Common  
Name

Family  
Name

Tolerance  
Value

### Coleoptera (Beetles)

Family	Tolerance Value	Number Found	Family Tolerance Score
Dryopidae	5	0	0
Dytiscidae	5	2	10
Elmidae	5	0	0
Gyrinidae	4	0	0
Halipidae	7	0	0
Hydrophilidae	5	3	15
Psephenidae	4	0	0
<b>Order Total</b>		<b>5</b>	<b>25</b>

### Order Summary

Order Total	Number Found	Order Tolerance
Coleoptera	<b>5</b>	<b>25</b>
Diptera	6	38
Ephemeroptera	8	28
Hemiptera	5	27
Lepidoptera	2	0
Megaloptera	0	0
Odonata	3	13
Plecoptera	0	0
Trichoptera	6	24
<b>Grand Total</b>	<b>35</b>	<b>155</b>

$$\text{Biotoic Index} = [\text{Grand Total Tolerance}] / [\text{Grand Total Number Found}] = 155/35 = 4.43$$

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